DESCRIPTION

CLEANING DEVICE FOR A HAIR REMOVING APPARATUS

TECHNICAL FIELD

The present invention is directed to a cleaning device for a hair removing apparatus, particularly a dry shaver with the use of a cleaning liquid.

BACKGROUND ART

U.S. Patent No. 6,263,890 shows a cleaning device for a dry shaver. The device is formed with a basin for accommodating therein a shaver head of the shaver, and a tank containing a volume of a cleaning liquid and communicating with the basin through a liquid supply channel. A pump is disposed in the liquid supply channel in order to supply the liquid from the tank into the basin for cleaning the shaver head, i.e., cutters and the associated parts. The tank is disposed immediately below the basin for collecting the liquid from the basin by gravity feed. A filter is fixed within the tank in order to separate contaminants or hairs dislodged from the head and carried by the circulating liquid for preventing the contaminants from entering the pump. When the filter is clogged, it has to be discarded together with the tank and therefore a large volume of the liquid contained in the tank.

U.S. Patent No. 5,711,328 suggests another cleaning device in which a drip pan is disposed immediately below the basin to receive the liquid dripped from the basin. The liquid is fed back to a separate tank holding a large volume of the tank. A pump is included to circulate the liquid through the tank, the basin and the drip pan. Also in this device, the filter is fixed within the tank so as to

supply the clean liquid from the tank into the basin. However, since the filter is fixed to tank, the filter cannot be cleaned or replaced without discarding the tank, i.e., the large volume of the liquid contained in the tank. This is inconvenience and even uneconomical in that the liquid cannot be reused.

DISCLOSURE OF THE INVENTION

The present invention has been accomplished in view of the above problem and provides an improved cleaning device for a hair removing apparatus. The cleaning device includes a housing provided with a basin that receives an operator head of the hair removing apparatus, a tank storing a volume of a cleaning liquid, and a pump supplying the liquid from the tank to the basin for cleaning the operator head. A drip pan is formed separately from the tank and is disposed underneath the basin for collecting the liquid dripping from the basin. The drip pan is connected to the tank by way of a fluid intake channel for allowing the liquid to return from within the drip pan to the tank under the action of the pump. The drip pan is open to the bottom of the basin for collecting the hairs or contaminants dislodged from the operator head. The feature of the present invention resides in that a filter is provided in the drip pan for removing the contaminants from the liquid. Thus, the filter can be cleaned or replaced without involving the tank and the liquid contained therein, enabling a continued use of the tank and the cleaning liquid and therefore assuring economical cleaning of the apparatus.

In a preferred embodiment, the drip pan is separated by the filter into a first chamber which is in direct communication with the basin and a second chamber having a connection port for direct connection with the fluid intake

channel. The connection port is designed to have a flow cross area smaller than the surface area of the filter so as to smoothly pass the liquid through the filter without rapidly clogging the filter.

The second chamber is preferred to communicate with an air vent that is formed in the housing and is open to the atmosphere not through the filter for introducing the air. The tank is provided in the form of a hermetically sealed container which is selectively open to the atmosphere by way of an air valve. The device includes a controller that selectively provides a supply mode for supplying the liquid to the basin from the tank and a recovery mode for recovering the liquid from the basin to the tank. In the supply mode, the pump is actuated while the air valve is kept closed so as to feed the air introduced through the air vent and the second chamber into to the tank by way of the fluid intake channel and therefore accumulate the air pressure within the tank, thereby forcing the liquid out of the tank to the basin. In the recovery mode, the pump is actuated while the air valve is kept opened so as to feed the liquid out from the basin through the fluid intake channel to the tank without accumulating the air pressure within the tank, thereby collecting the liquid into the tank. With the provision of the recovery mode, the liquid can be completely recovered into the tank to empty the drip pan, thereby facilitating the cleaning or replacement of the filter.

Most preferably, the drip pan is removably received within a recess formed in the housing below the basin so that the drip pan and the filter can be easily washed or cleaned for continued use.

The filter may be designed to have an upper area and a lower area so that the upper area is positioned above a level of the liquid dripped and stored

into the drip pan for introducing the air through the upper area into the second chamber. Thus, the outside air can be successfully drawn by the pump not through the liquid phase into the tank, while the filter can entrap hairs or contaminants possibly carried by the air.

The second chamber of the drip pan may have an inner bottom which is inclined downwardly to the connection port for facilitating the liquid flow to the tank, particularly in the recovery mode, for complete collection of the liquid into the tank.

Preferably, the drip pan is configured to have a liquid storing capacity larger than that of the basin. Thus, even if the pump stops during the supply mode, the drip can collect the whole volume of the liquid from the basin without causing any leakage around the drip pan.

The device may include a monitor that monitors whether or not the drip pan is attached to the housing so that the controller deactivates the pump in response to the drip pan being detached from the housing, assuring safe operation of the device.

Instead of providing the removable drip pan, the filter itself may be made removable from the housing to be easily cleaned. Also in this case, the controller may be arranged to deactivate the pump in response to the filter being detached from the housing.

These and still other advantageous features of the present invention will become more apparent from the following detailed description of the embodiment when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a cleaning system shaver in accordance with a preferred embodiment of the present invention;

FIG. 2 is a schematic view illustrating the operation of the above system;

FIG. 3 is a rear perspective view of the system in a rather schematic representation;

FIG. 4 is a front view of a dry shaver of the above system;

FIG. 5 is a circuit block diagram of the above device illustrating the operation of the above system;

FIG. 6 is a front perspective view of the above system with the dry shaver being removed therefrom;

FIGS. 7 and 8 are vertical sections of the above system, respectively with and without the shaver;

FIG. 9 is another vertical section of the above system;

FIG. 10 is a rear vertical section of the above system;

FIG. 11 is a front view of the above system;

FIG. 12 is a vertical section of a detachable tank utilized in the above system;

FIG. 13 is a top view of a drip pan utilized in the above system;

FIG. 14 is a vertical section of the drip pan;

FIG. 15 is a partial section showing a bottom of the drip pan and the associated portion of the device's housing; and

FIG. 16 is a vertical section of a modified drip pan.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to FIGS. 1 and 2, there is shown a cleaning device for cleaning a hair removing apparatus, for example, a dry shaver **10** or epilator with

the use of a cleaning liquid. The device has a housing **20** with a base **30** and a stand **40** upstanding from a rear end of the base. Formed at the front end of the base **30** is a basin **50** which is configured to receive an operator head, i.e., a shaver head **12** of the shaver **10**. The cleaning liquid is stored in a tank **100** detachably mounted to the stand **40** and is connected to the basin **50** for supplying the liquid into the basin and for recovering the liquid therefrom. The device includes a pump **70** which is controlled to circulate the cleaning liquid between the tank **100** and the basin **50** for cleaning the shaver head **12**. The cleaning operation continues for a predetermined period. Thereafter, a control is made to collect the liquid from the basin **50** into the tank **100**, details of which will be discussed later. Upon recovery of the liquid into the tank, a fan **200** is actuated to produce a forced air flow over the head **12** for drying the same.

As shown in FIG. 2, a drip pan **60** is disposed immediately below the basin **50** for collecting the liquid dripping and/or overflowing from the basin **50**. The drip pan **60** has a top opening which communicates with a drain port **52** at the bottom center of the basin **50**, and also with an overflow duct **34** leading to an upper edge of the basin **50**. The drip pan **60** has a filter **63** for entrapping hairs or contaminants dislodged from the shaver head **12** and carried by the liquid dribbling through the drain port **52** into the drip pan **60**. The liquid thus cleared of the contaminants is fed through a connection port **65** to a fluid intake channel **22** leading to the tank **100**. The pump **70** is disposed in the fluid intake channel **22** for drawing the liquid from the basin **50**. The fluid intake channel **22** is open to the atmosphere through the drain port **52**, the overflow duct **34**, and also through an air vent **36** formed in the base **30** around the basin **50**. Thus, depending upon the level of the liquid in the basin **50**, the outside air is drawn

alone or together with the liquid by the action of the pump **70** into the tank **100** through the fluid intake channel **22**. The tank **100** is provided in the form of a hermetically sealed container having an inlet and an outlet. The inlet is defined by a fluid inlet tube **102** which is detachably connected to the fluid intake channel **22** for taking in the liquid and/or the air. The outlet is defined by a liquid outlet tube **104** which is detachably connected to a liquid supply channel **24** formed in the housing **20** and leading to a spout **25** upwardly of the basin **50**, as best shown in FIG. 9, for flowing the liquid down into the basin **50**. Turning back to FIG. 2, the liquid outlet tube **104** is connected to a U-shaped sucking tube **105** which extends deep into the tank **100** to a point adjacent to the bottom of the tank for sucking the liquid. Further, the tank **100** is formed with an air exhaust tube **106** detachably connected to an air exhaust channel **26** which extends within the housing **20** and is open to the atmosphere through ventilation windows **29** or clearances in the walls of the housing **20**. An air valve **80** is disposed in the air exhaust channel **26** to selectively close the tank and open it to the atmosphere. The air valve **80** is realized by a normally-closed electromagnetic valve which opens upon being energized or supplied with an electric current. A cap **112** is detachably and sealingly mounted in a filling port **110** in the upper end of the tank **100** for replacing or replenishing the liquid.

Now, the operation of the device is discussed with reference to FIGS. 2 and 5. The device includes a power supply **90** providing an electric power to various electrical parts, and a controller **92** responsible for controlled operations of the associated parts. When a switch **94** is activated, the controller **92** responds to provide a supply mode and a recovery mode in sequence. In the supply mode, the pump **70** is activated with the air valve **80** being kept closed,

i.e., the tank being kept hermetically sealed. Initially, the basin **50** is substantially free from the liquid such that only the air is drawn and accumulated in the tank **100** to increase the inside air pressure. As the air pressure increases, the liquid in the tank **100** is forced to expel out through the liquid outlet tube **104** and the liquid supply channel **24** into the basin **50**. In this connection, it is noted that the drain port **52** of the basin **50** is dimensioned such that the flow rate of the liquid dripping into the drip pan **60** is smaller than that of the liquid being supplied from the tank **100**, thereby increasing the amount of the liquid in the basin **50**. After the basin **50** is filled with the liquid, an extra amount of the liquid is caused to overflow into the drip pan **60**, maintaining the liquid in the basin **50** at a constant level. In this connection, the air is continuously drawn into the tank with the superfluous liquid to keep supplying the liquid into the basin **50**, i.e., circulating the liquid between the tank **100** and the basin **50** for cleaning the shaver head **12**. The supply mode continues over a predetermined time period during which the shaver head is activated intermittently or continuously to shake the contaminants off, enhancing the cleaning effect.

The supply mode is automatically followed by the recovery mode in which the pump **70** is activated with the air valve **80** kept opened to collect the liquid from the basin **50** through the drip pan **60** into the tank **100**. With the air valve **80** being opened, i.e., the tank **100** opened to the atmosphere, the air drawn by the pump **70** is exhausted through the air valve **80** so as to recover the liquid and collect only the liquid in the tank **100**. The recovery mode continues over a predetermined time period to collect the whole liquid into the tank. Near the end of the period, the shaver head is controlled to be activated for shaking the liquid off. Thereafter, the fan **200** is activated to dry the shaver head with or

without the shaver head being actuated. Thus, the supply mode and the recovery mode are accomplished with the use of a single pump and the air valve.

As schematically shown in FIG.3, the tank **100** is L-shaped to have a wide header section **114** and a vertically elongated section **116** overlapping the rear face of the stand **40**. The tank **100** is mounted on the housing **20** with the horizontal section **114** resting on a mounting face **41** on top of the stand **40**. The fluid inlet tube **102**, the liquid outlet tube **104**, and the air exhaust tube **106** are integrally formed with the tank **100** to project on the bottom of the header section **114** for detachably connection with the fluid intake channel **22**, the liquid supply channel **24**, and the air exhaust channel **26**, respectively. For this purpose, the ends of the channels **22**, **24**, and **26** are integrated into a combination socket **28** formed in the mounting face **41**, as shown in FIG. 10. Thus, the tank **100** can be attached to the housing **20** from the above.

The device further includes a filter detector **98** which issues a stop signal when the drip pan **60** is not in position below the basin **50**. In response to the stop signal, the controller **92** deactivates the pump **70** and the associated parts to cease the above operation. A display **96** is included in the device to give information about which one of the supply mode and the recovery mode is proceeding, and the elapsed time. Further, a signal transmitting terminal **91** is provided on the side of the housing **20** for transmitting an electric signal that is received in a shaver controller **14** to activate the shaver head **12** or a charging circuit **16** for charging a battery **15**. As best shown in FIGS. 6 and 7, the terminal **91** includes a set of contacts **93** exposed on the front wall of the stand **40** for contact with a corresponding set of pads **13** formed on the exterior of the shaver **10**. The pads defines a signal receiving terminal **11** represented in FIG.

5 through which the signal is transmitted to the shaver controller **14**. The contacts **93**, i.e., the terminal **91** is located intermediate the height of the stand **40** for intimate contact with the pads **13** or the receiving terminal **11** when the shaver **10** is held upside down to place the shaver head **12** into the basin **50**. Alternatively, the signal transmitting terminal **91** may be in the form of a primary winding for transformer coupling with a secondary winding placed within the shaver as the signal receiving terminal **11**. In this modification, both of the windings can be concealed within the housing and shaver, respectively.

As shown in FIG. 6, the stand **40** carries a holding means, i.e., a mechanism of holding the shaver **10** in position. The mechanism includes a pair of clasps **42** which are spaced widthwise with respect to the height dimension of the housing **20** and are pivotally supported to the stand **40** to be movable between a holding position of bracing the shaver **10** and a releasing position permitting the removable of the shaver. The clasps **42** are biased by coil springs **43** to the holding position in which the clasps **42** engage the opposite sides of the shaver **10**. Each of the clasps **42** is formed at its upper and lower end respectively with inclined guides **44** for sliding contact with tapered head sides **18** as well as top tapered sides **19** adjacent to the shaver head **12**, as shown in FIG. 4. Thus, the clasps **42** can be forced to open temporarily in the release position when the shaver is moved vertically to place the shaver head **12** into the basin **50**, allowing the easy attachment of the shaver, after which the clasps close by the action of the springs into the holding position. Also, when the shaver is moved vertically to pull the shaver head **12** out of the basin **50**, the clasps **42** are forced to open by contact with the top tapered sides **19** of the shaver, permitting the easy detachment of the shaver from the device. In the

holding position, the clasps **42** urges the shaver **10** towards the stand **40** in order to keep the pads **13** of the receiving terminal **11** pressed against the corresponding contacts **93** for reliable signal transmission therebetween.

As shown in FIGS. 7 to 9, the stand **40** has a front face which is configured to guide the apparatus **10** to a holding position where the shaver head **12** is received within the basin **50**. For this purpose, the front face has is a guide face **46** which is inclined with respect to a vertical or height axis of the housing **20** and which is formed at its lower end with a stopper **48** for abutting against a shoulder of the apparatus or shaver **10**. The stopper **48** is positioned so that the apparatus **10** is caused to lean upon the front face of the stand by its own weight, thereby urging the pads **13** of the receiving terminal **11** against the contacts **93** of the transmitting terminal **91** for reliable electrical contact therebetween. In this sense, the electrical connection can be made successfully even without relying upon the springs **43** of the clasps **42**.

The drip pan **60** is made detachable to the housing **20** for easy cleaning of the filter **63** as well as the pan **60** itself. As shown in FIGS. 7, 8, and 14, the drip pan **60** is provided in the form of a drawer having a front handle **64** and the top opening which comes into fluid communication with the drain port **52** of the basin **50**, the air vent **36**, and the overflow duct **34** for receiving the liquid and/or the air therethrough. A recess **32** is formed at the front end of the base **30** immediately below the basin **50** to accommodate the drip pan **60**. The inner bottom of the pan **60** is inclined downwardly towards the connection port **65** for smoothly guiding the liquid to the fluid intake channel **22**. As shown in FIG. 14, the interior space of the drip pan **60** is divided by the filter **63** into a first chamber **61** and a second chamber **62**. The first chamber **61** is in direct open

communication with the drain port **52** and the overflow duct **34** for collecting the liquid and/or the air respectively therethrough, thereby depositing the contaminants carried by the liquid on the filter **63**. The second chamber **62** is in direct open communication with the air vent **36** and with the connection port **65** for feeding the liquid cleared of the contaminants as well as the outside air into the fluid intake channel **22**. For this purpose, the filter **63** is bent into an L-shaped section, as shown in FIG. 14. With this arrangement, the vertical portion of the filter **63** can be located above the level of the liquid in the drip pan **60** so as to entrap the contaminants possibly carried by the air drawn through the drain port **52** in the initial stage of the supply mode as well as in the last stage of the recovery mode.

As shown in FIG. 15, the drip pan **60** is formed with an electrode **66** which comes into contact with corresponding leads **68** at the bottom of the housing **20** when the drip pan **60** is received in the recess **32** of the housing **20**. The electrode **66** and the leads **68** constitute a switch which opens in response to the drip pan **60** being removed from the position below the basin **50**. The switch is electrically connected to the filter detector **98** which issues an enable signal to the controller **92** only when the drip pan is in the correct position, allowing the pump to be activated only in this condition. The drip pan **60** is designed to have a liquid storing capacity larger than that of the basin **50** in order to collect the entire volume of the liquid from the basin **50** even if the pump **70** should stop during the supply mode. The filter is preferred to have a filtering area of 700 mm^2 or more. Further, instead of providing the removable drip pan **60**, the filter **63** alone may be detachable to the housing for frequent cleaning purpose. Alternatively, the filter **63** may be made flat, as shown in FIG. 16, so that the

second chamber **62** communicates with the air vent **36** through the filter **63**. In this modification, the filter **63** can entrap contaminants carried by the air drawn also through the air vent **36**.

The cleaning device in accordance with the present invention can be equally applied for cleaning the epilating head of a hand-held epilator or other operator head of similar hair removing apparatus.